

IN THE CLAIMS:

Please amend the claims as set forth below. This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (Canceled)

Claim 2 (Currently Amended): A laser processing method ~~according to claim 1, for~~ irradiating an object to be processed with a first laser beam while converging the first laser beam with a lens such that a converging point is positioned within the object, and forming a modified region within the object along a cutting line, the method comprising:

a height acquiring step of irradiating the object with a second laser beam for measuring height of a main surface of the object while converging the second laser beam with the lens, and acquiring the height of the main surface along the cutting line while detecting reflected light reflected by the main surface in response to the irradiation of the object with the second laser beam; and

a processing step of emitting the first laser beam and moving the lens and the object relative to each other along the main surface while adjusting a gap between the lens and the main surface according to the acquired height, so as to form the modified region along the cutting line;

wherein the ~~displacement~~ height of the main surface along the cutting line to cut is acquired at a first time interval while moving the lens and the object relative to each other at a first speed along the main surface in the ~~displacement~~ height acquiring step; and

wherein the modified region is formed while moving the lens and the object relative to each other at a second speed faster than the first speed along the main surface and adjusting the

gap between the lens and the main surface at a second time interval shorter than the first time interval in the processing step.

Claim 3 (Currently Amended): A laser processing method ~~according to claim 1, for~~ irradiating an object to be processed with a first laser beam while converging the first laser beam with a lens such that a converging point is positioned within the object, and forming a modified region within the object along a cutting line, the method comprising:

a height acquiring step of irradiating the object with a second laser beam for measuring height of a main surface of the object while converging the second laser beam with the lens, and acquiring the height of the main surface along the cutting line while detecting reflected light reflected by the main surface in response to the irradiation of the object with the second laser beam; and

a processing step of emitting the first laser beam and moving the lens and the object relative to each other along the main surface while adjusting a gap between the lens and the main surface according to the acquired height, so as to form the modified region along the cutting line;

wherein the ~~displacement~~ height acquiring step comprises:

a measurement preparatory step of holding the lens at a measurement initial position set such that a converging point of the second laser beam is located at a predetermined position with respect to the object;

a ~~first measurement~~ step of starting emitting of the second laser beam while holding the lens at the measurement initial position, moving the lens and the object relative to each other along the main surface, and releasing the lens from being held at the measurement initial position in response to reflected light of the second laser beam reflected by the main surface; and

a ~~second measurement~~ step of adjusting the gap between the lens and the main surface after the release while detecting the reflected light of the second laser beam reflected by the main surface, so as to acquire the ~~displacement~~ height of the main surface along the ~~line to cut~~ cutting line.

Claim 4 (Currently Amended): A laser processing method ~~according to claim 1,~~ for irradiating an object to be processed with a first laser beam while converging the first laser beam with a lens such that a converging point is positioned within the object, and forming a modified region within the object along a cutting line, the method comprising:

a height acquiring step of irradiating the object with a second laser beam for measuring height of a main surface of the object while converging the second laser beam with the lens, and acquiring the height of the main surface along the cutting line while detecting reflected light reflected by the main surface in response to the irradiation of the object by the second laser beam; and

a processing step of emitting the first laser beam and moving the lens and the object relative to each other along the main surface while adjusting a gap between the lens and the main surface according to the acquired height, so as to form the modified region along the cutting line;

wherein the processing step comprises:

a processing preparatory step of setting a processing initial position for holding the lens with respect to the main surface according to the ~~displacement~~ height of the main surface along the cutting line ~~to cut~~ acquired by the ~~displacement~~ height acquiring step, and holding the lens at thus set processing initial position;

a first processing step of starting emitting of the first laser beam while holding the lens at the processing initial position, and moving the lens and the object relative to each other so as to form the modified region in one end part of the ~~line to cut~~; cutting line; and

a second processing step of releasing the lens from being held at the processing initial position after forming the modified region in the one end part of the ~~line to cut~~; cutting line, and moving the lens and the object relative to each other after the release while adjusting the gap between the lens and the main surface according to the ~~displacement~~ height of the main surface along the cutting line ~~to cut~~ acquired in the ~~displacement~~ height acquiring step, so as to form the modified region.

Claim 5 (Currently Amended): A laser processing method according to ~~claim 1~~ any one of claims 2 to 4, wherein, in the ~~displacement~~ height acquiring step, the first laser beam is emitted when acquiring the ~~displacement~~ height of the main surface along the ~~line to cut~~; cutting line, so as to form the modified region along the ~~line to cut~~ cutting line.

Claim 6 (Currently Amended): A laser processing method according to claim 5, wherein the modified region formed in the ~~displacement~~ height acquiring step is formed between the modified region formed in the processing step and the main surface.

Claim 7 (Currently Amended): A laser processing method according to ~~claim 1~~ any one of claims 2 to 4, wherein cutting the line ~~to cut~~ includes first and second ~~lines to cut~~; cutting lines;

wherein the ~~displacement~~ height acquiring step moves the lens relative to the object in a first direction extending along the first ~~line-to-cut~~, cutting line, so as to acquire the ~~displacement~~ height of the main surface along the first ~~line-to-cut~~, cutting line, and then moves the lens relative to the object in a second direction opposite from the first direction, so as to acquire the ~~displacement~~ height of the main surface along the second ~~line-to-cut~~, cutting line; and

wherein the processing step forms the modified region along the first ~~cutting line to-cut~~ in the first direction, and then forms the modified region along the second cutting line ~~to-cut~~ in the second direction.

Claim 8 (Canceled)

Claim 9 (Currently Amended): A laser processing apparatus ~~according to claim 8~~, for irradiating an object to be processed with a first laser beam while converging the first laser beam with a lens such that a converging point is positioned within the object, and forming a modified region within the object along a cutting line, the apparatus comprising:

a lens for converging the first laser beam and a second laser beam toward the object for measuring height of a main surface of the object;

height acquiring means for acquiring the height of the main surface of the object by detecting reflected light reflected by the main surface in response to irradiation of the object with the second laser beam;

moving means for moving the object and the lens relative to each other along the main surface of the object;

holding means for holding the lens such that the lens freely advances and retracts with respect to the main surface; and

control means for controlling respective behaviors of the moving means and holding means;

wherein, while the second laser beam is being emitted, the control means controls the moving means so as to move the object and the lens relative to each other along the main surface, the height acquiring means acquiring the height of the main surface along the cutting line; and

wherein, while the first laser beam is being emitted, the control means controls the holding means so as to hold the lens while adjusting a gap between the lens and the main surface according to the height acquired by the height acquiring means, and controls the moving means so as to move the lens and the object relative to each other along the main surface, thereby forming the modified region;

wherein, while ~~emitting~~ the second laser beam is being emitted, the control means controls the moving means so as to move the object and the lens relative to each other along the main surface at a first speed, the ~~displacement~~ height acquiring means acquiring the ~~displacement~~ height of the main surface along the cutting line ~~to cut~~ at a first time interval; and

wherein, while ~~emitting~~ the first laser beam is being emitted, the control means controls the moving means so as to move the lens and the object relative to each other along the main surface at a second speed faster than the first speed, and controls the holding means so as to adjust the gap between the lens and the main surface at a second time interval shorter than the first time interval.

Claim 10 (Currently Amended): A laser processing apparatus ~~according to claim 8, for~~
irradiating an object to be processed with a first laser beam while converging the first laser beam
with a lens such that a converging point is positioned within the object, and forming a modified
region within the object along a cutting line, the apparatus comprising:

a lens for converging the first laser beam and a second laser beam toward the object for
measuring height of a main surface of the object;

height acquiring means for acquiring height of the main surface of the object by detecting
reflected light reflected by the main surface in response to irradiation of the object with the
second laser beam;

moving means for moving the object and the lens relative to each other along the main
surface of the object;

holding means for holding the lens such that the lens freely advances and retracts with
respect to the main surface; and

control means for controlling respective behaviors of the moving means and holding
means;

wherein, while the second laser beam is being emitted, the control means controls the
moving means so as to move the object and the lens relative to each other along the main
surface, the height acquiring means acquiring the height of the main surface along the cutting
line; and

wherein, while the first laser beam is being emitted, the control means controls the
holding means so as to hold the lens while adjusting a gap between the lens and the main surface
according to the height acquired by the height acquiring means, and controls the moving means

so as to move the lens and the object relative to each other along the main surface, thereby forming the modified region;

wherein the control means controls the holding means so as to hold the lens at a measurement initial position set such that a converging point of the second laser beam is located at a predetermined position with respect to the object;

wherein, while starting the emission of the second laser beam with the lens being held at the measurement initial position, the control means controls the moving means so as to move the lens and the object relative to each other along the main surface, and controls the holding means so as to release the lens from being held at the measurement initial position in response to the reflected light of the second laser beam reflected by the main surface; and

wherein, after the release, the control means controls the holding means so as to adjust the gap between the lens and the main surface while detecting the reflected light of the second laser beam reflected by the main surface, the ~~displacement~~ height acquiring means acquiring the ~~displacement~~ height of the main surface along the ~~line-to-cut~~ cutting line.

Claim 11 (Currently Amended): A laser processing apparatus ~~according to claim 8, for~~ irradiating an object to be processed with a first laser beam while converging the first laser beam with a lens such that a converging point is positioned within the object, and forming a modified region within the object along a cutting line, the apparatus comprising:

a lens for converging the first laser beam and a second laser beam toward the object for measuring height of a main surface of the object;

height acquiring means for acquiring height of the main surface of the object by detecting reflected light reflected by the main surface in response to irradiation of the object with the second laser beam;

moving means for moving the object and the lens relative to each other along the main surface of the object;

holding means for holding the lens such that the lens freely advances and retracts with respect to the main surface; and

control means for controlling respective behaviors of the moving means and holding means;

wherein, while the second laser beam is being emitted, the control means controls the moving means so as to move the object and the lens relative to each other along the main surface, the height acquiring means acquiring the height of the main surface along the cutting line; and

wherein, while the first laser beam is being emitted, the control means controls the holding means so as to hold the lens while adjusting a gap between the lens and the main surface according to the height acquired by the height acquiring means, and controls the moving means so as to move the lens and the object relative to each other along the main surface, thereby forming the modified region;

wherein the control means controls the holding means so as to set a processing initial position for holding the lens with respect to the main surface according to the ~~displacement~~ height of the main surface along the cutting line ~~to cut~~ acquired by the ~~displacement~~ height acquiring means, and hold the lens at thus set processing initial position;

wherein, while starting the emission of the first laser beam with the lens being held at the processing initial position, the control means controls the moving means so as to move the lens and the object relative to each other, thereby forming the modified region in one end part of the ~~line to cut~~; cutting line; and

wherein, after forming the modified region in the one end part, the control means controls the holding means so as to release the lens from being held at the processing initial position and adjust the gap between the lens and the object according to the ~~displacement~~ height of the main surface acquired by the ~~displacement~~ height acquiring means, and controls the moving means so as to move the lens and the object relative to each other, thereby forming the modified region.

Claim 12 (Currently Amended): A laser processing apparatus according to ~~claim 8~~ any one of claims 9 to 11, wherein the ~~displacement~~ height acquiring means emits the first laser beam when acquiring the ~~displacement~~ height of the main surface, so as to form the modified region along the ~~line to cut~~ cutting line.

Claim 13 (Currently Amended): A laser processing apparatus according to claim 12, wherein the moving means is adapted to move the object toward the lens; and

wherein the control means controls the moving means such that the modified region formed along the cutting line ~~to cut~~ when the ~~displacement~~ height acquiring means acquires the ~~displacement~~ height is formed between the modified region formed later along the cutting line ~~to cut~~ and the main surface.

Claim 14 (Currently Amended): A laser processing apparatus according to ~~claim 8~~ any one of claims 9 to 11, wherein the cutting line to-cut includes first and second lines ~~to-cut~~; cutting lines;

wherein the control means controls the moving means so as to move the lens relative to the object in a first direction along the first ~~line to-cut~~, cutting line, while the ~~displacement~~ height acquiring means acquires the ~~displacement~~ height of the main surface along the first ~~line to-cut~~, cutting line, and then the control means controls the moving means such that the lens moves relative to the object in a second direction opposite from the first direction, while the ~~displacement~~ height acquiring means acquires the ~~displacement~~ height of the main surface along the second ~~line to-cut~~, cutting line; and

wherein, after forming the modified region along the first cutting line to-cut in the first direction, the control means controls the moving means so as to form the modified region along the second cutting line to-cut in the second direction.

Claim 15 (Currently Amended): A laser processing method according to claim 3, wherein the lens is held at the measurement initial position between a position corresponding to one end of the cutting line to-cut and a position corresponding to a position on the outside of the one end on an extension of the ~~line to-cut~~, cutting line, and between a position corresponding to the other end of the cutting line to-cut and a position corresponding to a position on the outside of the other end on the extension of the ~~line to-cut~~ cutting line.

Claim 16 (Currently Amended): A laser processing method according to claim 3, wherein the processing step comprises:

a processing preparatory step of setting a processing initial position for holding the lens with respect to the main surface according to the ~~displacement~~ height of the main surface along the cutting line to-cut acquired by the ~~displacement~~ height acquiring step, and holding the lens at thus set processing initial position;

a first processing step of starting emitting of the first laser beam while holding the lens at the processing initial position, and moving the lens and the object relative to each other so as to form the modified region in the one end part of the ~~line-to-cut~~; cutting line; and

a second processing step of releasing the lens from being held at the processing initial position after forming the modified region in the one end part of the ~~line-to-cut~~; cutting line, and moving the lens and the object relative to each other after the release while adjusting the gap between the lens and the main surface according to the ~~displacement~~ height of the main surface along the cutting line to-cut acquired in the ~~displacement~~ height acquiring step, so as to form the modified region.

Claim 17 (Currently Amended): A laser processing method according to claim 16, wherein the cutting line to-cut includes first and second ~~lines to-cut~~; cutting lines;

wherein the ~~displacement~~ height acquiring step moves the lens relative to the object in a first direction extending along the first ~~line-to-cut~~; cutting line, so as to acquire the ~~displacement~~ height of the main surface along the first ~~line-to-cut~~; cutting line, and then moves the lens relative to the object in a second direction opposite from the first direction, so as to acquire the ~~displacement~~ height of the main surface along the second ~~line-to-cut~~; cutting line; and

wherein the processing step forms the modified region along the first cutting line to-cut in the first direction, and then forms the modified region along the second cutting line to-cut in the second direction.

Claim 18 (Currently Amended): A laser processing method according to claim 3 or 4, wherein the cutting line to-cut includes first and second lines to-cut; cutting lines;

wherein the displacement height acquiring step moves the lens relative to the object in a first direction extending along the first line to-cut; cutting line, so as to acquire the displacement height of the main surface along the first line to-cut; cutting line, and then moves the lens relative to the object in a second direction opposite from the first direction, so as to acquire the displacement height of the main surface along the second line to-cut; cutting line; and

wherein the processing step forms the modified region along the first cutting line to-cut in the first direction, and then forms the modified region along the second cutting line to-cut in the second direction.

Claim 19 (Currently Amended): A laser processing apparatus according to claim 10, wherein the lens is held at the measurement initial position between a position corresponding to one end of the cutting line to-cut and a position corresponding to a position on the outside of the one end on an extension of the line to-cut; cutting line, and between a position corresponding to the other end of the cutting line to-cut and a position corresponding to a position on the outside of the other end on the extension of the line to-cut cutting line.

Claim 20 (Currently Amended): A laser processing apparatus according to claim 10, wherein the control means controls the holding means so as to set a processing initial position for holding the lens with respect to the main surface according to the ~~displacement~~ height of the main surface along the cutting line ~~to-cut~~ acquired by the ~~displacement~~ height acquiring means, and hold the lens at thus set processing initial position;

wherein, while starting the emission on the first laser beam with the lens being held at the processing initial position, the control means controls the moving means so as to move the lens and the object relative to each other, thereby forming the modified region in one end part of the ~~line to-cut~~; cutting line; and

wherein, after forming the modified region in the one end part, the control means controls the holding means so as to release the lens from being held at the processing initial position and adjust the gap between the lens and the object according to the ~~displacement~~ height of the main surface acquired by the ~~displacement~~ height acquiring means, and controls the moving means so as to move the lens and object relative to each other, thereby forming the modified region.

Claim 21 (Currently Amended): A laser processing apparatus according to claim 20, wherein the cutting line ~~to-cut~~ includes first and second ~~lines to-cut~~; cutting lines;

wherein the control means controls the moving means so as to move the lens relative to the object in a first direction along the first ~~line to-cut~~; cutting line, while the ~~displacement~~ height acquiring means acquires the ~~displacement~~ height of the main surface along the first ~~line to-cut~~; cutting line, and then the control means controls the moving means such that the lens moves relative to the object in a second direction opposite from the first direction, while the

~~displacement height~~ acquiring means acquires the ~~displacement height~~ of the main surface along the second ~~line to cut~~; cutting line; and

wherein, after forming the modified region along the first cutting line ~~to cut~~ in the first direction, the control means controls the moving means so as to form the modified region along the second cutting line ~~to cut~~ in the second direction.

Claim 22 (Currently Amended): A laser processing apparatus according to claim 10 or 11, wherein the cutting line ~~to cut~~ includes first and second ~~lines to cut~~; cutting lines;

wherein the control means controls the moving means so as to move the lens relative to the object in a first direction along the first ~~line to cut~~; cutting line, while the ~~displacement height~~ acquiring means acquires the ~~displacement height~~ of the main surface along the first ~~line to cut~~; cutting line, and then control means controls the moving means such that the lens moves relative to the object in a second direction opposite from the first direction, while the ~~displacement height~~ acquiring means acquires the ~~displacement height~~ of the main surface along the second ~~line to cut~~; cutting line; and

wherein, after forming the modified region along the first cutting line ~~to cut~~ in the first direction, the control means controls the moving means so as to form the modified region along the second cutting line ~~to cut~~ in the second direction.

Claim 23 (New): A laser processing method according to claim 2, wherein the displacement acquiring step comprises:

a measurement preparatory step of holding the lens at a measurement initial position set such that a converging point of the second laser beam is located at a predetermined position with respect to the object;

a first measurement step of starting emitting the second laser beam while holding the lens at the measurement initial position, moving the lens and the object relative to each other along the main surface, and releasing the lens from being held at the measurement initial position in response to reflected light of the second laser beam reflected by the main surface; and

a second measurement step of adjusting the gap between the lens and the main surface after the release while detecting the reflected light of the second laser beam reflected by the main surface, so as to acquire the displacement of the main surface along the line to cut.

Claim 24 (New): A laser processing method according to claim 23, wherein the processing step comprises:

a processing preparatory step of setting a processing initial position for holding the lens with respect to the main surface according to the displacement of the main surface along the line to cut acquired by the displacement acquiring step, and holding the lens at thus set processing initial position;

a first processing step of starting emitting the first laser beam while holding the lens at the processing initial position, and moving the lens and the object relative to each other so as to form the modified region in one end part of the line to cut; and

a second processing step of releasing the lens from being held at the processing initial position after forming the modified region in the one end part of the line to cut, and moving the lens and the object relative to each other after the release while adjusting the gap between the

lens and the main surface according to the displacement of the main surface along the line to cut acquired in the displacement acquiring step, so as to form the modified region.

Claim 25 (New): A laser processing apparatus according to claim 9, wherein the control means controls the holding means so as to hold the lens at a measurement initial position set such that a converging point of the second laser beam is located at a predetermined position with respect to the object;

wherein, while starting the emission of the second laser beam with the lens being held at the measurement initial position, the control means controls the moving means so as to move the lens and the object relative to each other along the main surface, and controls the holding means so as to release the lens from being held at the measurement initial position in response to the reflected light of the second laser beam reflected by the main surface; and

wherein, after the release, the control means controls the holding means so as to adjust the gap between the lens and the main surface while detecting the reflected light of the second laser beam reflected by the main surface, the displacement acquiring means acquiring the displacement of the main surface along the line to cut.

Claim 26 (New): A laser processing apparatus according to claim 25, wherein the control means controls the holding means so as to set a processing initial position for holding the lens with respect to the main surface according to the displacement of the main surface along the line to cut acquired by the displacement acquiring means, and hold the lens at thus set processing initial position;

wherein, while starting the emission of the first laser beam with the lens being held at the processing initial position, the control means controls the moving means so as to move the lens and the object relative to each other, thereby forming the modified region in one end part of the line to cut; and

wherein, after forming the modified region in the one end part, the control means controls the holding means so as to release the lens from being held at the processing initial position and adjust the gap between the lens and the object according to the displacement of the main surface acquired by the displacement acquiring means, and controls the moving means so as to move the lens and the object relative to each other, thereby forming the modified region.